

XVIII.—*Descriptions of Cremnobates Syhadrensis and Lithotis rupicola, two new Generic Forms of Mollusca inhabiting Cliffs in the Western Ghats of India.* By WILLIAM T. BLANFORD, A.R.S.M., F.G.S.

[Plate IV.]

Family Littorinidæ.

CREMNOBATES, nov. gen.

Testa perforata, turbinato-globosa, costulata. Apertura mediocris, subovata; peristomatis margine dextro simplici, columellari vix calloso.

Operculum testaceum, subovatum, paucispirale; nucleo sinistro; margine membranaceo.

Animal (pulmoniferum?) parvum; tentaculis duobus brevibus subulatis, oculos in lobis tumidis ad basin gerentibus præditum. Pes brevis, rotundatus. Proboscis brevis.

C. Syhadrensis, n. sp.

C. testa subobtecte perforata, globoso-turbinata, costulis elevatis crenulatis circumdata, inter costulas liris minoribus spiralibus lineisque obliquis decussantibus incrementi ornata, periomphalo haud costulato concentricè decussato-striato albida, ad apicem rubella, epidermide viridi-fusca induta; spira brevis, conoidea, sutura impressa, apice acuto, plerumque erosulo; anfractibus 3, rapide accrescentibus, convexis, ultimo rotundato, circa perforationem angulato; apertura diagonalis, ovata, lineis longitudinalibus fusco-purpureis prope suturam et versus basin marginis dextri, spatio interveniente, interne signata, interdum omnino colorata; peristoma simplex, marginibus callo junctis, dextro recto, basali expansulo, columellari reflexo, appresso, perforationem partim tegente. Operculum normale.

Alt. 7, diam. 7 mill.; apertura 5 mill. longa, 4 lata.

Hab. in montibus "Syhadri" seu "Western Ghats," Indiæ orientalis, ad scopulos basalticos pendentes adhærens.

This very remarkable and interesting form appears to be one of the links connecting the Littorinidæ with operculated Pulmonifera. It occurs abundantly on the precipitous bare rocks of the Western Ghats of India, in the neighbourhood of Bombay. These mountains, which are entirely composed of basaltic lava-flows, rise suddenly from the low ground of the Concan, or country bordering the sea, to a height of 2000 feet, their scarp being extremely abrupt, and in many parts forming an almost precipitous inland cliff. In consequence of the neighbourhood of the sea, and the sudden change in the elevation of the ground, the rainfall is very heavy during the south-west monsoon, from June till October, and the surface of the rocks must be almost continually wet. In December the only specimens of *Cremno-*

bates which I found in motion were living on the wet rock in a place where a small stream trickled down the surface of a steep rocky ledge; everywhere else the shells were firmly attached to the rock in crevices and hollows. I am therefore, I think, justified in considering this form as rather an amphibious than a true land-shell; and this view is confirmed by the circumstance that when placed in a glass of water, the animals sometimes crawl out and creep about the glass, but quite as frequently remain beneath the water or just at its surface. Many Indian species of the genus *Littorina* itself are equally amphibious in their habits, always keeping at the limit of the advancing tide as long as possible, and, in some cases, inhabiting rocks far above the extent of the spray in ordinary tides and fair weather. I have thus met with *L. Malaccana*, Phil., in crevices of rocks several feet above high-water mark of ordinary tides, on the coast of Burma, in a place where they must frequently have remained many days, if not weeks, without being wetted by the sea.

I have carefully examined several individuals of *Cremnobates* without being able to detect any trace of gills, while the large vascular sac at the back of the neck exactly resembles that in the operculated land-shells*. The mantle-margin is free, and the sexes distinct. The lingual ribbon is very long; one from a large specimen measured $\frac{2}{3}$ inch (17 mill.); the teeth are 7-ranked, but differ in form from those of Cyclostomaceous genera. The amphibious habits of the animal, the short foot, and the olive-green epidermis, so characteristic of fresh-water shells, induce me to place it in the vicinity of *Lithoglyphus*. *Cremnobates* is well distinguished from that genus by its perforation, sculpture, and testaceous operculum, resembling in the two former characters the genus *Fossar*, species of which abound on parts of the Indian coast. One of the common Indian species of *Littorina* also, *L. ventricosa*, Phil., bears a considerable general resemblance to the form now described, and has a somewhat similar though less strongly marked sculpture. Young specimens of *Cremnobates* are frequently imperforate, the umbilicus being entirely covered by the columellar margin of the peristome.

Should my opinion as to the pulmoniferous character of this genus be confirmed, its place amongst the families of operculated land-shells will be difficult to determine. Its subulate tentacles and undivided foot distinguish it from *Cyclostoma*, its paucispiral and excentrically nucleated operculum from *Cyclopho-*

* My own experience in Molluscan anatomy is too small for me to state positively that no gills exist, until my observations have been confirmed by a better observer.

rus and its allies; it wants the long proboscis of *Truncatella*, and differs in both operculum and tentacles from the minute Indian shells ascribed to *Hydrocena**, which otherwise resemble it both in the form of the shell and in their rocky habitat. Every character of shell, operculum, and animal, with the one exception of the pulmoniferous sac, admits of the position I have assigned to it amongst the *Littorinidæ*, in the neighbourhood of *Fossar* and *Lithoglyphus*. If delegated to the Pulmonifera, a new family must be founded for it; and it will certainly add to the doubts of many naturalists as to the correctness of the retention of two groups, so distinct in many of their characters as are the *Helicea* and the *Cyclostomacea*, in the same "subclass" on account of the identity of one particular organ.

No question can exist as to the Western Ghats having formed a marine cliff in comparatively recent geological times. Whether *Cremnobates* be a lineal descendant of the *Littorinas* or *Fossars* then inhabiting the coast may perhaps not be an unfair subject for speculation.

Fam. Helicidæ.

Sub-family Succininæ.

Genus Succinea.

LITHOTIS, subg. nov.

Testa auricularis, ovata, tenuis, carina longitudinali externa, sulco interno correspondente prope suturam munita; apertura permagna, continua; spira minima.

Animal tentaculis carentibus (?), oculis magnis in summis pedunculis duobus retractilibus, brevibus, versus basin tumidis, positus: pes brevis, pyriformis.

L. rupicola, sp. nov.

Testa ovata, pertenuis, succinea, curvate costulato-striata; spira plana, sutura vix depressa; anfractibus $1\frac{1}{4}$, ultimo prope aperturam descendente; carina ex apice oriens, spiralis, peristomatibus ad marginem dextrum, 2 mm. a sutura, desinens; apertura permagna, ovata, continua, intus politissima, nitida; peristoma tenue, rectum, margine columellari callose appresso.

Diam. maj. 7 mill., min. 5, alt. $2\frac{1}{2}$.

Hab. in montibus Syhadri cum *Cremnobate Syhadrensi*.

The above are the dimensions of the largest specimen I possess. This species appears to be very nearly as remarkable a link as that last described; for it combines the characters of *Camptonyx*

* *H. sorrita*, Bens., *H. pyxis*, B., *H. frustillum*, B., &c. The operculum has no spiral structure, being simply excentrically striated, as in *Helicina*; the tentacles are lobate. I propose to separate these species under the generic name of *Georissa*.

and *Otina*, belonging to the *Auriculea*, with those of *Succinea* and its allies. From the shell alone, which has the form of *Otina*, with the substance, texture, and peculiar external ridge and internal furrow of *Camptonyx*, I should have supposed the present species to belong to the last-named genus; but the retractile eye-bearing peduncles prove its place to be in the neighbourhood of *Succinea*, from which genus the internal furrow for a siphon distinguishes it as a well-marked subgenus. Tentacles are extremely small and rudimentary in several of the subgenera of *Succinea*, and, in the present case, appear to be wanting; if present, they are certainly very inconspicuous. The animal of *Helisiga*, Less., as represented in Adams's Gen. Rec. Moll., pl. 73, closely resembles that of *Lithotis*, but has a larger foot, while the shell only differs in the absence of the siphonal furrow.

Lithotis abounds adhering to the precipitous basaltic rocks of the Western Ghats, like *Cremnobates*, but apparently in rather more exposed situations, being perhaps more purely an air-breather, and requiring less moisture than its congener. Both probably feed upon the confervoid vegetation covering the surface of the rock to which they adhere.

I am indebted to the kindness of Mr. A. B. Mynne for the accompanying drawings of the shells above described.

EXPLANATION OF PLATE IV.

Figs. 1, 2. *Cremnobates Syhadrensis*, natural size.

Fig. 3. The same, enlarged 2 diameters.

Figs. 4, 5. The same; operculum enlarged 2 diameters.

Figs. 6, 7. Animal of the same.

Figs. 8, 9, 10. *Lithotis rupicola*, natural size.

Fig. 11. The same, enlarged 2 diameters.

Fig. 12. The same; animal from below.

XIX.—On Cephalization, and on *Megasthenes* and *Microsthenes* in Classification (being in continuation of an Article on the Higher Subdivisions in the Classification of Mammals). By JAMES D. DANA*.

IN the paper on the "Classification of Mammals," published by the writer in Silliman's Journal (vol. xxxv. p. 65)†, and also in his earlier paper on Crustaceans, the principle of cephalization is shown to be exhibited among animals in the following ways:—

1. By a transfer of members from the *locomotive* to the *cephalic* series.

* Communicated by the Author. From the 'American Journal of Science and Arts,' vol. xxxvi. (July 1863).

† See Ann. and Mag. Nat. Hist. March 1863, p. 207.